WNISAT-1

Nanosatellite for north arctic routes and atmosphere monitoring

2010 August 9th
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Introduction of WNISAT-1

WNISAT-1?
- Nano class remote sensing satellite
- Project is started from the commercial objects between Weathernews and Axelspace

Object of WNISAT-1
- Northern sea routes monitoring
- CO₂ gas monitoring

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<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Size</strong></td>
<td>27cm × 27cm × 27cm</td>
</tr>
<tr>
<td><strong>Mass</strong></td>
<td>10kg</td>
</tr>
<tr>
<td><strong>Electrical power</strong></td>
<td>12.6W</td>
</tr>
<tr>
<td><strong>Communication</strong></td>
<td>UHF, GMSK</td>
</tr>
<tr>
<td></td>
<td>9.6kbps(Up), 38.4kbps(Down)</td>
</tr>
<tr>
<td><strong>Attitude control</strong></td>
<td>3 axis control</td>
</tr>
<tr>
<td></td>
<td>Better than 0.1deg for accuracy</td>
</tr>
<tr>
<td><strong>Expected orbit</strong></td>
<td>Sun synchronous</td>
</tr>
<tr>
<td></td>
<td>670km, 10:00LTDN</td>
</tr>
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Missions of WNISAT-1

Mission 1: Northern sea routes

- Because of global warming, the available time of the northern sea routes is getting longer.
- Many sea liners want the information of the arctic sea because of the cost reduction (time and fuel consumption).
- WNISAT-1 monitors the arctic area for the customized information.
- The information will be provided by the global ice center of Weathernews Inc.
Cameras for the mission 1

- Following customer’s request, 500km × 500km area is covered with 500m GSD
- Two bands are used for the mission 1: visible band and near-infrared ray band
- 10 photos/day can be downloaded to the ground station
- The time gap from the shooting to the downloading is expected with a half day
- Under development by AXELSPACE
Mission 2: CO₂ gas monitoring

- The density of CO₂ gas has strong relationship with global warming
- Provide an open project to monitor the density of CO₂ gas

**WNI Satellite** emits laser beams at two wavelengths

- Laser of 1570 nm
- Laser of 1556 nm

Atmospheric CO₂ content absorbs laser-beam of 1570nm → beam weakening

CO₂ does NOT absorb laser-beam of 1556nm → no beam weakening

Simple detecting system adapting 30cm class parabolic reflector

**WNI Supporters** participate CO₂ Monitoring
Laser emission system for the mission 2

- Emission time: about 10 ~ 20 sec
- Beam spot of the ground has $\phi 5 ~ 10$ km
- Required accuracy for the orbit information: about 2 km
- Required accuracy for the attitude control: better than 0.1 deg
- Under development by Wheathernews Inc.
Bus system of WNISAT-1

- Simple and compact architecture with practical reliability
- Aggressive use of COTS (Commercial Off The Shelf) devices
- Every parts were tested about the space environment
- Autonomous functions for the easy operation
Attitude control and star tracker

- Mission 2 of CO₂ density monitoring needs high accuracy for the attitude control
- Reaction wheels and some sensors are added for this high accuracy
- Especially, star trackers are developed by AXELSPACE to provide accurate attitude determination

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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<tbody>
<tr>
<td>Maximum error</td>
<td>30 [arcsec], 3σ 0.2 [deg], 3σ, boresight</td>
</tr>
<tr>
<td>Field of view</td>
<td>8° × 8°</td>
</tr>
<tr>
<td>Magnitude of visible stars</td>
<td>Above 6</td>
</tr>
<tr>
<td>Sun angle of disturbance</td>
<td>80°, short hood 35°, Long hood</td>
</tr>
<tr>
<td>Power consumption</td>
<td>1.8 [W]</td>
</tr>
<tr>
<td>Information update rate</td>
<td>1 [Hz]</td>
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</table>
Ground station for WNISAT-1

- Two ground stations are under construction in Japan
- Main station operates the satellite under normal circumstance
- Another sub station supports main station, and act as a spare station
Conclusion

- The development process is under EM stage
- Environmental tests are undergoing to check the feasibility of design
- Expecting PSLV(C-17) of India for the launcher
- Launch date will be on the late 2011
WNISAT-1 is aim for the verification of the satellite

After this WNISAT-1, more WNISAT series are scheduled for the constellation
Thank you for your attention

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